(D4)

PATENT SPECIFICATION

DRAWINGS ATTACHED

888,116

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COMPLETE SPECIFICATION

Drive Mechanism

I, GAETANO THOMAS TRIGILIO, of 3676 East 117th Street, Cleveland, Ohio, United States of America, a citizen of the United States of America, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a drive mechanism of the type comprising plural rotary elements and a common driving shaft therefor.

Such a driving arrangement is utilized in many different devices and systems wherein it is desirable or even essential that jamming or overloading of one rotary element causes the same automatically to become disengaged from the shaft, so that the other elements may continue to operate. These elements thus may take the form of pulleys, sprockets, or gears, a multiple gear pump of the type designed for aircraft being a good example of such a device. In this last case, the driving gears of plural sets of gears type fuel pumps are mounted on the same shaft and connected thereto in such manner as to provide independent shearing in the event of seizing of any driving gear.

In accordance with the present invention, there is provided a frangible coupling between a drive shaft and more than one gear elements rotatably mounted thereon which, as usual, are driven by this shaft, in which each of the rotatable elements is formed with an inwardly serrated drive formation, a series of coupling elements spaced circumferentially of the shaft is provided for each of these rotatable elements, which coupling elements are connected to the shaft and co-operate with the drive formation of the rotatable element, and that the coupling elements have generally radial portions between the shaft and the rotatable element which are intentionally weakened, whereby, a predetermined overload or the like on the gear element causes it to become uncoupled from the shaft independently of the other gear elements by virtue of a fracture at the weakened portions of the coupling elements.

A preferred embodiment of the invention is set forth in the accompanying drawings, in which:—

Fig. 1 is an elevational view, partially in section, of a drive arrangement in accordance with the present invention;

Fig. 2 is a transverse cross-sectional view taken approximately along the line 2—2 in Fig. 1;

Fig. 3 is a top plan view of a coupling member or bar used in this assembly;

Fig. 4 is a side elevational view of such bar;

Fig. 5 is a further transverse cross-sectional view taken approximately along the line 5—5 in Fig. 1;

Fig. 6 is a side elevation of a modified form of shaft coupling;

Fig. 7 is an end view of the coupling shown in Fig. 6;

Fig. 8 shows in elevation a further modification of the invention; and

Fig. 9 is a transverse cross-sectional view taken approximately along the line 9—9 in Fig. 8.

Referring now to the drawing in detail, the preferred embodiment of the invention illustrated in Figs. 1 to 5 comprises a driving shaft 10 having two gears 11 and 12 mounted thereon in axially spaced relation and adapted to be driven by such shaft. Such gears may, for example, be the driving gears of two gear pumps and, from what has been said earlier, it will be understood that the specific character of the rotary elements is not a critical factor in the invention, whereby the illustrated gears could as well be pulleys, sprockets or other rotary drive means.

The shaft 10 is formed with an integral portion 13 of increased diameter intermediate its ends and such portion is provided with four equally spaced, axial slots 14 to a depth which is preferably greater than the difference between the diameters of the shaft proper and

[*Price 4s. 6d.*]

such enlarged portion 13. As illustrated, the bottoms of such slots are thus located within the normal cross-sectional area of the shaft, and the ends of each slot are inclined outwardly from the planes of the ends of the enlarged portion to the periphery of the shaft at both sides, as shown at 15. Elongated coupling members or bars 16 of the particular formation evident most clearly in Figs. 3 and 4 are fitted in such slots.

Each coupling bar 16 is substantially rectangular in cross-section and has a central or main portion 17 of the same length as the enlarged portion 13 of the shaft. Over such central portion, each bar is of a height slightly greater than the depth of the slot 14 receiving the same and, for a purpose to be described, the outer or top surface of the bar is provided with a small, rounded transverse groove 18. Each bar at one end has a terminal portion 19 of reduced height and a contiguous connecting portion 20 through which such end portion is joined to the main or central portion 17. Similarly formed and connected end and intermediate portions 21 and 22, respectively, are provided at the other end of the bar, and the bottom surfaces of both the intermediate portions 20 and 22 are inclined correspondingly as the ends of the shaft slot 14 in each case.

The intermediate portions 20 and 22 of the several bars are furthermore weakened by vertical grooves 23 formed in their side faces, so that these portions constitute shear sections. The reduced height of the end portions 19 and 21 of the bars is such that their bottom or inner surfaces overlie the adjacent sections of the shaft 10, whereby such end portions are connected to the shaft only through the shear sections. When inserted in their slots, the several coupling bars 16 are of course keyed to the shaft, and a snap ring 24 is fitted about the assembly to hold the bars in place, the transverse top grooves 18 of the bars and a further peripheral groove in the enlarged shaft portion accommodating this ring.

Such snap ring is of course intended primarily to facilitate assembly, and other expedients could obviously be used for this purpose. For example, the ring would not be needed if the bars are sized for press fitting in the shaft slots.

The inner or adjacent ends of the journals of the two gears are internally splined and interengaged with the respectively adjacent axially extending end portions of the coupling members 16 for drive through the latter. Accordingly, this shaft assembly will be seen to provide independent first and second series of shear connections to the gears and that, by appropriate degree of weakening, each gear is protected from predetermined excessive torque on the other. It is, moreover, important to note that the shearing of the driving connection in each case occurs in the coupling members associated with the shaft and not in the journals of the gears. When convenient to repair the assembly, it is thus a simple matter to substitute new coupling bars, which is obviously much more economical than replacement of the rotary elements.

The coupling device shown in Figs. 6 and 7 provides equivalent operation with less machining of the shaft. This device is in the form of a sleeve 25 which is internally splined for engagement on an externally splined intermediate section of the driving shaft. At one end, this sleeve is provided with integral and circumferentially spaced axial extensions 26 which correspond to the bar end portions 19 in the first described embodiment and, similarly as the latter, these axial extensions are weakened by grooves 27, at their junctions at the end face of the sleeve. A second set of such extensions or lugs 28, with weakening grooves 29, are formed at the other end of the sleeve to provide the further independently shearable series of driving elements corresponding to the earlier described coupling bar end portions 21. Thus, in this modification the shear sections are again between the shaft and the members in driving engagement with the gears and, in fact, the only significant change is the structural one of employing a keyed sleeve body in lieu of the enlarged shaft portion and separate bars keyed therein.

The shaft 30 to Figs. 8 and 9 likewise provides independently shearable driving connections for the two gears or other rotary elements, the coupling members here being integral portions of the shaft. Each such member, designated generally by reference numeral 31, comprises a relatively short radial portion 32 and an outer portion 33 extending axially from such radial portion in slightly spaced relation to the periphery of the shaft proper. The axial portions 33, drivingly engaged with the gears in the complete assembly, extend respectively in opposite directions from the radial portions in the first and second circumferentially spaced series of the same, and the radial connecting portion of each such member is weakened by transverse grooves as illustrated for shearing from the shaft.

It will be clear that in each such form of the invention, the number of coupling members can be varied as may be appropriate in the particular installation in which the new drive mechanism is to be employed.

WHAT I CLAIM IS:—

1. A frangible coupling between a drive shaft and more than one gear elements rotatably mounted thereon which, as usual, are driven by this shaft, in which each of the rotatable element is formed with an inwardly serrated drive formation, a series of coupling elements spaced circumferentially of the shaft is provided for each of these rotatable elements, which coupling elements are connected to the shaft and co-operate with the drive

formation of the rotatable element, and that the coupling elements have generally radial portions between the shaft and the rotatable element which are intentionally weakened, whereby a predetermined overload or the like on the gear element causes it to become uncoupled from the shaft independently of the other gear elements by virtue of a fracture at the weakened portions of the coupling elements.

2. A coupling as claimed in Claim 1, in which the coupling elements extend axially from their generally radial portions about the shaft and into engagement with the rotatable elements.

3. A coupling as claimed in Claim 1 or 2, in which two series of coupling elements are located on the shaft between a pair of the rotatable elements and extend axially in opposite directions from their radial portions for respective engagement with the rotatable elements.

4. A coupling as claimed in any preceding claim, in which the axial portions of the coupling elements are lugs projecting from a sleeve removably keyed on the shaft, with generally radial weakened portions where the projections are joined to the body of the sleeve.

5. A coupling as claimed in any preceding claim, in which the coupling elements are bars having portions keyed to the shaft and other portions free of the shaft circumferentially spaced about it, with the weakened generally radial portions between such keyed and free portions.

6. A coupling as claimed in any preceding claim, in which the coupling elements are formed integrally with the shaft.

7. A coupling as claimed in Claim 6, in which each coupling element is integrally joined to the shaft by a weakened radial portion.

8. A coupling as claimed in Claim 1, substantially as hereinbefore described with reference to the accompanying drawings.

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888116 COMPLETE SPECIFICATION

1 SHEET This drawing is a reproduction of the Original on a reduced scale

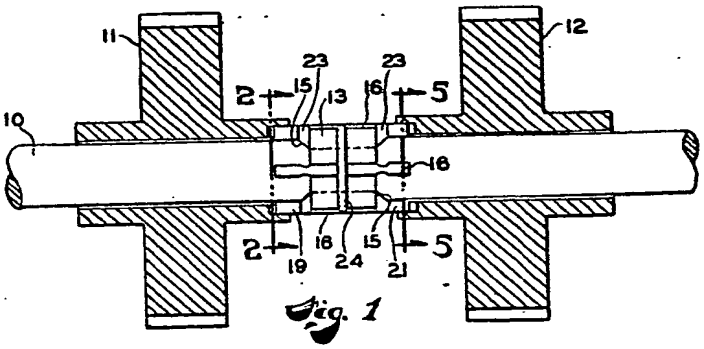

Fig. 1

Fig. 3

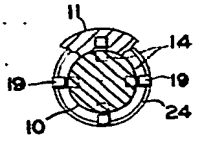

Fig. 2

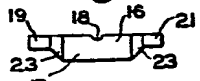

Fig. 4

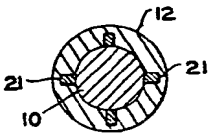

Fig. 5

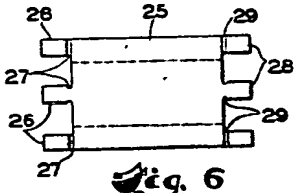

Fig. 6

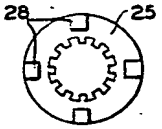

Fig. 7

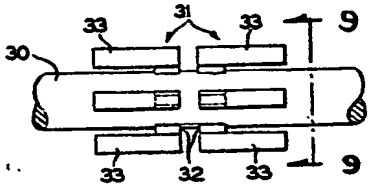

Fig. 8

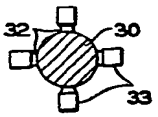

Fig. 9